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Abstract

FAST-NEUTRON SPECTRA OF A POOL-TYPE REACTOR[1] AND A SHIELDED-DIODE SPECTROMETER

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Measurements have been made of the spectra of fast neutrons within the core of a pool-type reactor, at the core-shield interface and at various positions in the water with a shielded spectrometer. Distances varied to 60 cm along the normal to the reactor face and to 40 cm at 51° and 40.5° from the normal. The data obtained along the normal to the reactor face show a hardening of the spectrum with increased distances in water and the presence of dips in the spectrum corresponding to resonances in the oxygen total cross section at 1.3, 3.7, and 4.1 to 4.3 MeV. These dips essentially disappear and the spectrum becomes softer at 51° and 41.5°. The data have been compared with theoretical calculations.

The shielded-diode spectrometer described herein has been found to be extremely capable of measuring fast-neutron reactor spectra in the midst of intense gamma-ray and fast-neutron backgrounds. The spectrometer consists of an independently supported Li^6F layer between two separated silicon surface-barrier diodes. Neutrons are detected by observing co-incidences between the alpha particles and the tritons produced in the $Li^6(n,\alpha)T$ reaction for which the Q value is 4.78 MeV. Substitution of a Li^7F layer for the Li^6F layer provides good accuracy in the measurement of the background from (n, charged-particle) reactions in silicon. The response of the spectrometer is linear over the neutron energy range from 0 to 14.7 MeV. The detection efficiency was measured to be ~ 3.5×10^{-3} for thermal neutrons and estimated to be 5.2×10^{-7} for 3-MeV neutrons.

1/ Work done at Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA.